



US 20160276585A1

(19) **United States**(12) **Patent Application Publication****Kim et al.**(10) **Pub. No.: US 2016/0276585 A1**(43) **Pub. Date: Sep. 22, 2016**(54) **GRAPHENE-INSERTED PHASE CHANGE
MEMORY DEVICE AND METHOD OF
FABRICATING THE SAME****Publication Classification**(51) **Int. Cl.**
H01L 45/00 (2006.01)(52) **U.S. Cl.**
CPC **H01L 45/128** (2013.01); **H01L 45/144**
(2013.01); **H01L 45/06** (2013.01); **H01L 45/16**
(2013.01); **H01L 45/126** (2013.01)(71) Applicants: **Samsung Electronics Co., Ltd.**,
Suwon-si (KR); **The Board of Trustees
of the Leland Stanford Junior
University**, Palo Alto, CA (US)(72) Inventors: **Yongsung Kim**, Suwon-si (KR); **Chiyui
Ahn**, Palo Alto, CA (US); **Aditya Sood**,
Palo Alto, CA (US); **Eric Pop**, Palo Alto,
CA (US); **H.S. Philip Wong**, Palo Alto,
CA (US); **Kenneth E. Goodson**, Palo
Alto, CA (US); **Scott Fong**, Palo Alto,
CA (US); **Seunghyun Lee**, Palo Alto,
CA (US); **Christopher M. Neumann**,
Palo Alto, CA (US); **Mehdi Asheghi**,
Palo Alto, CA (US)(57) **ABSTRACT**

Provided is a phase change memory device including a graphene layer inserted between a lower electrode into which heat flows and a phase change material layer, to prevent the heat from being diffused to an outside so as to efficiently transfer the heat to the phase change material layer, and a method of fabricating the phase change memory device. The phase change memory device includes a lower electrode; an insulating layer formed to enclose the lower electrode; a graphene layer formed on the lower electrode; a phase change material layer formed on the graphene layer and the insulating layer; and an upper electrode formed on the phase change material layer. Since a phase of the phase change material layer is changed at a small amount of driving current, the phase change memory device is fabricated to have a high driving speed and a high integration.

(21) Appl. No.: **15/011,199**(22) Filed: **Jan. 29, 2016****Related U.S. Application Data**(60) Provisional application No. 62/135,816, filed on Mar.
20, 2015.